(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 350 291 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication of patent specification: **14.09.94**

(51) Int. Cl.5: **A61B 17/34**

(21) Application number: **89306830.4**

(22) Date of filing: **05.07.89**

Divisional application 93200932.7 filed on 05/07/89.

(54) Improved safety trocar.

(30) Priority: **06.07.88 GB 8816033**

(43) Date of publication of application:
10.01.90 Bulletin 90/02

(45) Publication of the grant of the patent:
14.09.94 Bulletin 94/37

(84) Designated Contracting States:
AT BE CH DE ES FR GB IT LI LU NL SE

(56) References cited:
EP-A- 0 135 364
US-A- 4 654 030

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Description

This invention relates to trocars used to puncture tissue for the performance of laparoscopic or arthroscopic surgery and, in particular, to such trocars which employ a safety device to shield the obturator point immediately after the point has perforated tissue.

A trocar generally comprises two major components, a trocar tube and an obturator. The trocar tube is inserted through the skin to access a body cavity through the tube in which laparoscopic or arthroscopic surgery is to be performed. In order to penetrate the skin, the distal end of the trocar tube is placed against the skin and an obturator is inserted through the tube. By pressing against the proximal end of the obturator the point of the obturator is forced through the skin until it enters the body cavity. At this time the trocar tube is inserted through the perforation made by the obturator and the obturator is withdrawn, leaving the trocar tube as an accessway to the body cavity.

It has been found that often a great deal of force is required to cause the obturator point to penetrate the skin and underlying tissue. When the point finally breaks through this tissue, resistance to penetration is suddenly removed, and the obturator point can suddenly penetrate to reach internal organs of the body, which may cause lacerations and other injury to the internal organs. To avert this danger to the patient, trocars have been developed which carry a spring-loaded tubular shield within the trocar tube and surrounding the obturator. The distal end of the shield will press against the skin as the obturator point penetrates the body until the obturator has formed a perforation with a diameter sufficient to allow the shield to pass through. At that time the resistance of the tissue to the spring-loaded shield is removed, and the shield will spring forward to extend into the body cavity, surrounding the point of the obturator. The shield thus protects the internal body organs from inadvertent contact with the point of the obturator. A trocar including such a safety shield is described in U.S. Patent 4,535,773, for example.

The tubular shield in such a trocar will, however, require the incision formed by the obturator to extend to a considerable diameter before the resistance of the tissue pressure has been sufficiently decreased to allow the safety shield to spring forward. It is only when the incision attains the diameter of the shield that the shield is fully able to spring into the body cavity. When the obturator employs a long, tapered cutting tip, this tip must extend a significant distance into the body before the incision is sufficiently enlarged to release the safety shield. It would therefore be desirable to provide a safety shield which will spring forward to shield the obturator tip as soon as possible after entry is gained to the body cavity.

EP-135364 discloses a trocar including a trocar tube having a proximal and a distal end, an obturator having a perforating tip and extendable through the tube to perforate tissue at the distal end of the tube, said perforating tip having a three-sided pyramidal shape, and containing three cutting edges, and further including a safety shield extendable to shield the tip of the obturator, said safety shield exhibiting a rounded distal end with a slot for passage of said obturator tip therethrough. The safety shield has a frusto-conical distal end exhibiting a flat, distal surface normal to the longitudinal axis of the trocar.

In accordance with the principles of the present invention, a trocar is provided according to claim 1. The trocar includes a safety shield for a trocar obturator which exhibits a rounded, bullet-shaped distal end. A slot is formed in this distal end which corresponds to the geometry of the obturator tip, through which the tip extends during perforation of the skin. With this distal end conforming to the geometry of the tip, a smooth transition is provided from the tip to the distal end of the shield, enabling the shield to closely follow the obturator tip through the tissue. The rounded distal end will press against the skin and tissue in close proximity to the periphery of the incision as it is formed, and will aid in the enlargement of the incision to enable the shield to move forward when entry is gained into the body cavity.

In the drawings:

FIGURES 1 and 2 illustrate, for comparison with the present invention, the use of the trocar tube.

FIGURES 3-8 illustrate a trocar safety shield with a bullet-shaped nose;

FIGURES 9-11b and 18 illustrate operation of a trocar with a bullet nosed shield;

FIGURES 12-12d illustrate a bullet nosed safety shield when used with a triangular-pointed obturator;

FIGURES 13-15b illustrate operation of a trocar with a bullet nosed shield and a triangular-pointed obturator;

FIGURE 16 illustrates the penetration of tissue by a trocar with a bullet nosed safety shield;

FIGURE 17 illustrates the penetration by a trocar with a prior art trocar tube;

FIGURES 19-21 illustrate a trocar with an angularly disposed valve at the proximal end of the trocar tube;

FIGURE 22 illustrates apparatus for permitting only incremental advancement of the obturator of a trocar;

FIGURES 23-26 illustrate a control on a trocar for regulating insufflation of the body; and

FIGURES 27 and 28 an obturator and shield which requires only a short extenstion of the obturator from the distal end of the shield.

A safety trocar is shown for the purposes of illustration only in FIGURE 1. The trocar includes a trocar tube or cannula 10 having an open distal end 12 and an open, flanged proximal end 14. The proximal end 14 is mounted in a trocar handle 16. A spring 18 is located inside the handle and abuts the flanged end of the trocar cannula 10 and a stop 19 within the handle 16. There is an aperture 20 at the proximal end of the handle 16 which is surrounded by a gasket ring 22.

An obturator 24 is slideably and removeably located within the trocar cannula and is inserted into the handle and trocar cannula by way of the aperture 20. At its proximal end is an obturator handle 26, and the distal end of the obturator is sharpened to a point 28. The safety trocar of FIGURE 1 is used to puncture a hole in soft tissue by placing the distal end 12 of the trocar cannula 10 against the tissue, and pressing against the obturator handle 26. As pressure is exerted against the obturator handle, the trocar cannula 10 begins to compress the spring 18 inside the trocar handle 16 and the trocar cannula retracts into the handle 16. This retraction of the trocar cannula exposes the obturator point 28, which punctures the tissue. FIGURE 2 shows the spring 18 fully compressed within the trocar handle 16 and the obturator point 28 fully exposed beyond the distal end 12 of the trocar cannula. When the obturator point 28 breaks through the inner surface of the tissue, the spring-loaded trocar cannula 10 will spring forward around the obturator 24, shielding the obturator point to prevent inadvertent contact of the point with internal organs of the body inside the tissue being punctured.

FIGURE 3 shows a safety trocar according to the present invention in which like reference numerals refer to the elements previously described in FIGURE 1. In FIGURE 3 the obturator 24 is enclosed in a bullet nosed obturator shield 32. The obturator shield 32 is flanged at its proximal end to engage a spring 30 within the obturator handle 26. At its distal end the obturator shield has a slotted bullet-shaped nose 34. An end view of the bullet nose 34 is shown in FIGURE 5a, with its slot 36. The slot 36 is seen to extend radially to the outer periphery of the bullet nose at the distal end of the obturator shield 32. In FIGURE 3 the springs 18 and 30 are shown in their uncompressed positions.

When pressure is initially exerted at the obturator handle 26, the spring 30 within the obturator handle compresses, as shown in FIGURE 4. This compression of the spring 30 causes the obturator point 28 to extend beyond the bullet nose 34 of the shield through the slot 36, as shown in FIGURE 5b. Further exertion of pressure at the handle 26 will cause the trocar cannula to compress the spring 18, and the obturator point will then begin to extend out the distal end 12 of the trocar cannula 10. The extended obturator point will then puncture the tissue at the distal end of the trocar cannula until the point breaks through the inner surface of the tissue. At that time the resistance at the distal end of the trocar will be removed, and the spring 18 will extend the trocar cannula 10 forward about the point 28 of the obturator. When the obturator and obturator handle are withdrawn from the trocar cannula, the bullet nosed shield will continue to protect the point of the obturator after it has been used. The spring-loaded trocar cannula 10 provides protection against accidental puncture of an organ within the body, and the shield 32 continues to provide protection against user injury after the obturator is withdrawn from the trocar cannula.

The bullet nosed end 34 of the shield 32 is shown in enlarged views in FIGURES 6-8. FIGURE 6 shows an enlarged end view of the bullet nose 34 with a star-shaped slot 36. In the side view of FIGURE 7, the slot 36 is seen to extend toward the rear of the shield as indicated at 36a. The sharpened edges of the star-shaped obturator point will thus extend radially through slots 36a to the outer perimeter of the shield, and will hence cut a puncture the same diameter as the outer diameter of the shield 32. When the puncture is the same size as the shield, the shield is enabled to readily spring forward to protect the point of the obturator as it breaks through the inner surface of the tissue. The cross-sectional view of the bullet nose 34 in FIGURE 8 shows the rearward extension of the slot 36a in which the edges of the obturator point slide, and the widened inner diameter 39 within the shield proximal the nose for the shaft of the obturator. The bullet nose 34 of the shield aids penetration through the punctured tissue and improves the blending between the obturator facets and the cannula, thereby improving the responsiveness of the spring-loaded cannula.

Operation of the trocar with bullet nosed shield of FIGURES 3-8 is shown in FIGURES 9-11. FIGURE 9 is a perspective view of the trocar with the trocar cannula 10 compressed inside the trocar handle 16 so that the bullet nose 34 of the shield extends from the distal end 12 of the trocar cannula. An end view of the distal end of the instrument is shown in FIGURE 10. FIGURE 11a is an enlarged side view of the distal end of the instrument of FIGURE 9, with the bullet nose 34 extended and the star-shaped obturator point 28 still retracted within the shield. In FIGURE 11b the obturator point 28 is shown extended from the slot 36 of the bullet nose 34.

FIGURES 12-12d are similar to FIGURES 6-8, and show the bullet nose 34 of the shield 32 when used with a triangular-pointed obturator. FIGURE 12 shows the bullet nose 34 in cross-section, with slot 36a extending along the side of the shield. FIGURE 12a is a view of the distal end of the bullet nose, showing the triangular slot 36 extending to the periphery of the shield. FIGURES 12b, 12c, and 12d are cross-sectional views taken as indicated for areas B, C, and D of FIGURE 12.

Operation of the trocar with a triangular pointed obturator is as shown in FIGURES 13-15b. FIGURE 13 is a perspective view of the trocar, with the trocar cannula pressed into the handle 16 to reveal the bullet nose 34 of the shield at the distal end 12 of the trocar cannula. The indicator on the obturator handle is in the "on" position, indicating to the user that the obturator point 28 is retracted within the bullet nosed shield 32. FIGURE 14 shows the distal end of the instrument and the trianglar point 28 of the obturator within the triangular slot 36. FIGURE 15a shows the bullet nose 34 of the shield 32 entending beyond the distal end 12 of the trocar cannula 10, with the obturator point 28 still within the bullet nose 34. FIGURE 15b shows the obturator point 28 in its extended position. It may be seen that the edge 29 of the obturator point 28 is fully extended to the outer periphery of the bullet nosed shield 32 so as to cut a puncture of the same diameter as that of the shield. The three semi-circular fingers of the rounded bullet nose 34 will then fold the three opposing flaps of tissue aside as the shield 32 springs forward around the obturator point 28 when the puncture is made. In addition there is less trauma to the skin caused by pressing the rounded bullet nose fingers against the tissue as compared to the trauma caused by a tube-like shield.

An embodiment of an obturator and shield which requires only a short extension of the obturator point is shown in FIGURES 27 and 28. In this embodiment there are no slots 36a extending along the sides of the shield from the end slot 36. Instead, the obturator point 28 cuts only to a radial dimension 31 at the outer edges of the point, within the inner diameter 34' of the shield. In prior art instruments which cut to this radius, the obturator point must be extended out of the shield to the blend 37 of the point 28 and the round shaft 33 of the obturator. In the illustrated embodiment, the obturator point 28 need be extended only half this distance from the bullet nosed shield 34 in order to achieve a cut of the full point diameter.

In the embodiment of FIGURES 27 and 28 the hemispheric bullet-shaped nose of the shield is seen to comprise three distal lobes, 134a, 134b, and 134c, each with a semicircular distal end 135a, 135b, and 135c which define the slot through which the obturator point 28 extends. The triangular pyramidal obturator tip 28 has three substantially flat surfaces or faces 128a, 128b, and 128c which are ground to blend into the cylindrical shaft 33 of the obturator as shown at 37. FIGURE 28 shows that each lobe 134a, 134b, and 134c is thickened to have a substantially flat inner surface 136a, 136b, 136c, one of which is shown in this FIGURE. This inner surface contacts and fits against the proximal surface of the corresponding face of the obturator tip when the tip is fully extended, at which time the proximal edge 137a, 137b, 137c of each thickened lobe is substantially aligned with the blend 37 of each face. Thus, the geometry of the bullet-shaped nose is closely aligned with that of the obturator tip, and the lobes will fit against the faces of the tip and follow the tip into the perforation as it is cut by the tip. The lobes will spread the edges of the perforation to accommodate the bullet-nosed shield and the shield will then spring forward to protect the obturator tip as soon as the tip breaks through the tissue.

FIGURES 16 and 17 compare operation of the safety trocar of the present invention with that of prior instruments. Both FIGURES show trocars in operation just as the obturator tip breaks through the tissue 50. FIGURE 17 illustrates operation of known instruments, in which the shield for the obturator point is a tubular shield 44. This shield engages the tissue being punctured as shown at 45. This shield is not able to overcome the tissue resistance at 45 and spring forward to protect the obturator point until the obturator has made a puncture with a radius as indicated by R_m. When this occurs, the obturator point 28 is already well within the body and may have already damaged organs inside the body. By comparison, the bullet nosed shield 34 contacts the tissue outside the puncture site at points indicated at 35 in FIGURE 16. These contact points are at a much smaller radius R_d from the obturator point 28. This smaller radius, together with the spherical shape of the nose 34, enable the bullet nosed shield to spring forward through the puncture at a much earlier time than the prior tubular shield, thereby protecting the point 28 of the obturator as soon as it breaks through the tissue.

By virtue of this superior protective action, a trocar can be made to rely solely on the protective action of the spring-loaded shield 32 without the spring-loaded trocar cannula. An embodiment of this type is shown in FIGURE 18. The trocar cannula 70 is attached at its proximal end to the cannula handle 16. The obturator shield 32 and obturator 24 slide within the trocar cannula 70. A flange 66 at the proximal end of the shield 32 engages the spring 30, and is slideably engaged within a passageway 68 in the obturator handle 26.

The bullet nose 34 of the shield is shown extended beyond the distal end 12 of the trocar cannula, but with the obturator point 28 still retracted within the shield. As the spring 30 is compressed when the bullet nose 34 contacts the tissue being punctured, the obturator point 28 will extend beyond the bullet nose and puncture the tissue. Once the point has broken through the tissue, the bullet nosed shield 32 will spring through the puncture to shield the point 28 within the body.

Prior to and after retraction of the obturator from the body, the body at the puncture site is generally insufflated with air. To prevent the air from escaping through the puncture, the trocar cannula and handle are generally equipped with a valve mechanism to prevent air leakage. FIGURE 19 is a cross-sectional view of the trocar handle 16, showing a proximal tubular passageway 80 which is angled at its distal end. At the distal end of the passageway 80 is a flap valve 74 which is hinged at 75. A rubber-like sealing pad 78 is located on the side of the flap valve which contacts the distal end of the passageway 80. At the proximal end of the passageway 80 is a replaceable gasket 72 which has an aperture 73. The use of gaskets with different diameter apertures permits the trocar to be used with instruments of many different sizes. The internal diameter of the passageway 80 is sized to allow the shield 32 to smoothly slide through the passageway with the gasket 72 providing a seal around the shield. FIGURE 21 shows an enlarged view of the trocar handle 16, the obturator handle 26, the passageway 80, and the gasket 72.

FIGURE 20 shows the shield 32 and obturator 24 completely inserted within the trocar cannula 70. After the puncture is made, the shield 32 and obturator 24 are withdrawn from the trocar cannula 70, and the flap valve 74 swings shut against the distal end of the passageway 80 as the shield 32 clears the distal end of the passageway. The flap valve swings closed under the force of a spring 76. The distal end of the passageway 80 is thus securely sealed against air leakage while the shield is still sealing the proximal end of the passageway 80 at the gasket 72. The angled distal end of the passageway 80 permits the flap valve to be easily pushed open by the shield, or any endoscope instrument and prevents the shield from becoming jammed between the sealing pad 78 and the passageway as the flap valve closes. The distance between the flap valve 74 and the proximal gasket 72 ensures that the valve will be completely closed before the shield is removed from the gasket. Additionally the design of the trocar of FIGURE 20 enables a user to selectively expose the obturator point or retract it into the shield.

During some surgical procedures, a substantial amount of force is required to cause the obturator to puncture the tissue. The sudden release of back pressure as the puncture is achieved often causes the obturator to burst through the tissue and injure organs within the body. FIGURE 22 shows a trocar which prevents this sudden breakthrough and extension into the body. Located within the obturator handle 26 is a mechanism 92 connected to the obturator or shield 32 which permits only incremental advancement of the obturator. In FIGURE 22 this mechanism 92 is illustrated as a pivoting toothed cam 94, which engages matching teeth 96 on the shield 32. A return spring 98 is connected to the proximal end of the cam 94 so that the mechanism 92 will exhibit a ratchet-like operation, permitting extension of the obturator in small incremental distances. The mechanism 92 permits the obturator to be extended only a total distance "P" into the body, which is sufficient to provide a puncture of the desired diameter. The ratchet mechanism 92 is only illustrative of the types of mechanisms that may be employed. Other suitable mechanisms include a linear or rotary double pawl clock escapement, or a coarse pitch screwing action whereby the obturator is incrementally advanced as the obturator handle is turned. Either these or other suitable mechanisms will permit only incremental advancement of the obturator while providing tactile feedback to the surgeon indicating that the obturator is being advanced through the tissue.

FIGURES 23-26 illustrate a control on the trocar handle for enabling regulation of the insufflation of the body. The control includes a pivotally mounted lever 100 located on the top of the trocar handle 16. The lever 100 is moveable to three discrete positions: off, insufflate, and desufflate. At a position just forward of the lever 100 is an insufflation fitting 102, located over a passageway 108 which leads to the interior of the handle 16. Connected to the pivot shaft 104 of the lever is a key 106, which pivots with the lever.

FIGURE 25 is a plan view of the handle 16 with the top of the handle removed. In this view the key 106 is seen to have two ears 112 and 114, each with an upward extending central dimple. As the key is rotated with the lever, the dimples trace an arc along the top of the handle. Located in this arc of travel are the passageway 108 and two depressions 120 and 122, which act as detent positions for the dimples on the key ears 112 and 114. Located on the proximal extension of the key 106 is a pointer 110, which opposes an upward extension 75 of the flap valve 74 within the handle 16 (see FIGURE 24). FIGURE 24 illustrates that the angled distal end of the passageway 80 may have its own circular gasket 78' located around the distal end of the passageway.

When the lever 100 is rotated to the "off" position, the dimple on the key ear 112 clicks into

the depression 120 and the dimple on the key ear 114 fits into the inner end of the insufflation passageway 108, thereby sealing the passageway. With the passageway 108 sealed, pressurized air inside the trocar cannula 70, the trocar handle 16 and the body will not leak out of the insufflation fitting. The flap valve 74 seals the distal end of the passageway 80 at this time.

When it is desired to insufflate the body, a source of pressurized gas is connected to the insufflation fitting 102 and the lever is moved to the "insufflate" position as shown in FIGURES 23, 24, and 25. In this position the passageway 108 is not blocked by the key 106 and pressurized gas may enter the interior of the handle and the trocar cannula through the insufflation fitting 102, insufflating the body. After the body has been properly insufflated with gas, the lever 100 may be moved back to the "off" position to seal the pressurized gas in the trocar, and the gas source may be removed from the fitting 102. When it is desired to desufflate the body, the lever 100 is pivoted to the "desufflate" position as shown in FIGURE 26. The pivoting of the lever causes the key pointer 110 to contact the flap valve extension 75 and swing the flap valve away from its sealing position at the distal end of the passageway 80. Pressurized gas within the handle and trocar cannula will thus be vented through the passageway 80. As the key swings to its detent position the dimple on the key ear 114 clicks into the depression 122 and the dimple on the key ear 112 seals the passageway 108 to prevent the venting of air through the passageway 108 and the insufflation fitting 102.

Claims

1. A trocar including a trocar tube (10) having a proximal (14) and a distal (12) end, an obturator (24) having a perforating tip (28) and extendable through the tube (10) to perforate tissue at the distal end (12) of the tube (10), said perforating tip (28) having a three-sided pyramidal shape, and containing three cutting edges, and further including a safety shield (32) extendable to shield the tip (28) of the obturator (24), said safety shield (32) exhibiting a rounded distal end (34) with a slot (36) for passage of said obturator tip (28) therethrough, characterized in that said slot (36) is bounded by three distally extending semicircular lobes (134a, b, c) formed on the distal end of said shield (32), such that the proximal ends of said lobes (134a, b, c) oppose each other on either side of said cutting edges while said obturator tip (28) is extended through said slot (36), and said slot (36) generally conforming to the geometry of said obturator tip (28) such that each of said semicircular lobes (134a, b, c) fits against said obturator tip (28) while entering the perforation created by the tip (28) to spread the perforation.

2. The trocar of claim 1, wherein said rounded distal end (34) is hemispherical in profile.

3. The trocar of claim 1 or claim 2, wherein each of said lobes (134a, b, c) includes an inner surface (136a, b, c) which contacts a face of said pyramidal obturator tip (28) when said tip (28) is fully extended through said slot (36).

4. The trocar of any one of claims 1-3, wherein said slot (36) extends radially to the outermost radial cutting edge of said obturator tip (28).

5. The trocar of any preceding claim, further comprising:

   a housing (16) located at the proximal end of said trocar tube (10); and

   resilient means (18) located at the proximal end (14) of said trocar tube (10) and permitting said trocar tube (10) to retract proximally to allow said obturator tip (28) to extend distal to the distal end (12) of said trocar tube (10) when force is exerted against said distal end (12) of said trocar tube (10), and enabling said trocar tube (10) to extend in a distal direction when said force is removed.

6. The trocar of claim 5, wherein said resilient means (18) comprises a spring (18), said trocar tube (10) includes a proximal flange (14), said housing (16) includes an abutment surface (19), and said spring (18) is mounted for compression between said flange (14) and said abutment surface (19).

Patentansprüche

1. Trokar mit einer Trokarröhre (10) mit einem proximalen Ende (14) und einem distalen Ende (12), einem Obturator (24), der eine Perforationsspitze (28) aufweist und durch die Röhre (10) ausfahrbar ist, um am distalen Ende (12) der Röhre (10) Gewebe zu perforieren, wobei die Perforationsspitze (28) eine dreiseitige, pyramidenartige Klinge aufweist mit drei Schneidkanten, und darüber hinaus mit einer Sicherheitsabschirmung (32), die ausfahrbar ist, um die Spitze (28) des Obturators (24) abzuschirmen, wobei die Sicherheitsabschirmung (32) ein abgerundetes distales Ende (34) mit einem Schlitz (36) zum Durchgang der Obturatorspitze (28) dahindurch aufweist,

   dadurch gekennzeichnet, daß

der Schlitz (36) durch drei sich distal erstrekkende, halbkreisförmige Zipfel (134a, b, c) begrenzt ist, die auf dem distalen Ende der Abschirmung (32) ausgebildet sind, derart, daß die proximalen Enden der Zipfel (134a, b, c) auf jeder Seite der Schneidkanten einander gegenüberliegen, während die Obturatorspitze (28) durch den Schlitz (36) ausgefahren wird, und der Schlitz (36) im wesentlichen mit der Geometrie der Obturatorspitze (28) übereinstimmt, derart, daß jeder der halbkreisförmigen Zipfel (134a, b, c) sich gegen die Obturatorspitze (28) anlegt, während sie in die Perforation eindringt, die durch die Spitze (28) geschaffen worden ist, um die Perforation zu weiten.

2. Trokar nach Anspruch 1, bei dem das abgerundete distale Ende (34) im Profil halbkugelförmig ist.

3. Trokar nach Anspruch 1 oder 2, bei dem jeder der Zipfel (134a, b, c) eine Innenfläche (136a, b, c) aufweist, die sich in Kontakt mit einer Oberfläche der pyramidenartigen Obturatorspitze (28) befindet, wenn die spitze (28) vollständig durch den Schlitz (36) ausgefahren ist.

4. Trokar nach einem der Ansprüche 1 bis 3, bei dem der Schlitz (36) sich radial zur äußersten radialen Schneidkante der Obturatorspitze (28) erstreckt.

5. Trokar nach einem vorhergehenden Anspruch, weiterhin aufweisend:
ein Gehäuse (16), das am proximalen Ende der Trokarröhre (10) angeordnet ist; und
eine elastische Einrichtung (18), die am proximalen Ende (14) der Trokarröhre (10) angeordnet ist und ein proximales Zurückziehen der Trokarröhre (10) ermöglicht, um der Obturatorspitze (28) zu ermöglichen, distal zum distalen Ende (12) der Trokarröhre (10) auszufahren, wenn eine Kraft auf das distale Ende (12) der Trokarröhre (10) ausgeübt wird, und zu ermöglichen, daß die Trokarröhre (10) in distaler Richtung ausfährt, wenn die Kraft weggenommen wird.

6. Trokar nach Anspruch 5, bei dem die elastische Einrichtung (18) eine Feder (18) aufweist, die Trokarröhre (10) einen proximalen Flansch (14) aufweist, das Gehäuse (16) eine Anschlagfläche (19) aufweist, und die Feder (18) zur Kompression zwischen dem Flansch (14) und der Anschlagfläche (19) montiert ist.

Revendications

1. Trocart comportant un tube (10) pourvu d'une extrémité proximale (14) et d'une extrémité distale (12), un obturateur (24) comportant un bout de perforation (28) et pouvant être sorti à travers le tube (10) pour perforer un tissu à l'extrémité distale (12) du tube (10), ledit bout de perforation (28) ayant une forme de pyramide à trois côtés et comportant trois bords de coupe, le trocart comportant en outre un protecteur de sécurité (32) pouvant être sorti pour protéger le bout (28) de l'obturateur (24), ledit protecteur de sécurité (32) étant pourvu d'une extrémité distale arrondie (34) comportant une fente (36) permettant le passage dudit bout d'obturateur (28), caractérisé en ce que ladite fente (36) est délimitée par trois lobes demi-circulaires (13a, b, c) ayant une orientation distale et formés à l'extrémité distale dudit protecteur (32), de telle sorte que les extrémités proximales desdits lobes (134a, b, c) soient placées dans des positions mutuellement opposées de part et d'autre desdits bords de coupe pendant que ledit bout d'obturateur (28) est sorti à travers ladite fente (36), et ladite fente (36) épouse d'une façon générale la géométrie dudit bout d'obturateur (28) de sorte que chacun desdits lobes demi-circulaires (134a, b, c) s'applique contre ledit bout d'obturateur (28) pendant la pénétration dans la perforation créée par le bout (28) de façon à ouvrir la perforation.

2. Trocart selon la revendication 1, dans lequel ladite extrémité distale arrondie (34) a un profil hémisphérique.

3. Trocart selon la revendication 1 ou la revendication 2, dans lequel chacun desdits lobes (134a, b, c) comporte une surface intérieure (136a, b, c) qui est en contact avec une face dudit bout pyramidal d' obturateur (28) quand ledit bout (28) est complètement sorti à travers ladite fente (36).

4. Trocart selon une quelconque des revendications 1 à 3, dans lequel ladite fente (36) s'étend radialement vers le bord de coupe radialement extérieur dudit bout d'obturateur (28).

5. Trocart selon une quelconque des revendications précédentes, comprenant en outre :
   - un carter (16) situé à l'extrémité proximale dudit tube de trocart (10) ; et
   - un moyen élastique (18) situé à l'extrémité proximale (14) et dudit tube de tro-

cart (10), en permettant audit tube de trocart (10) de se rétracter en sens proximal afin que ledit bout d'obturateur (28) puisse se déplacer en sens distal, jusqu'à l'extrémité distale (12) dudit tube de trocart (10) quand une force est exercée contre ladite extrémité proximale (12) dudit tube de trocart (10), et en permettant audit tube de trocart (10) de se déplacer dans en sens distal quand ladite force est supprimée.

6. Trocart selon la revendication 5, dans lequel ledit moyen élastique (18) comprend un ressort (18), ledit tube de trocart (10) comporte une collerette proximale (14), ledit carter (16) comporte une surface de butée (19) et ledit ressort (18) est monté de façon à être comprimé entre ladite collerette (14) et ladite surface de butée (19).

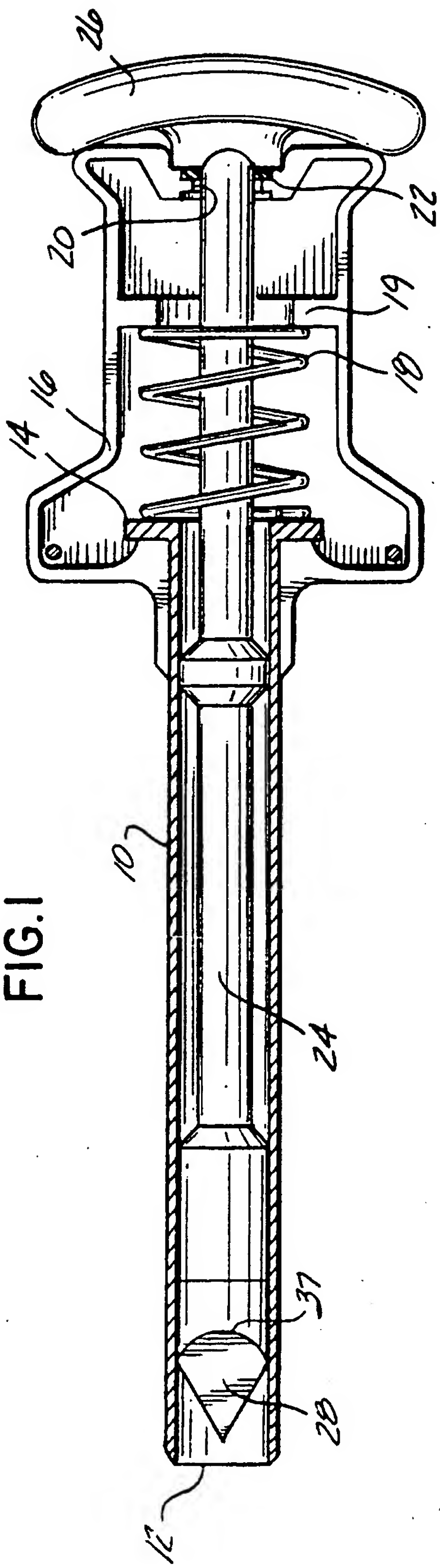

FIG.1

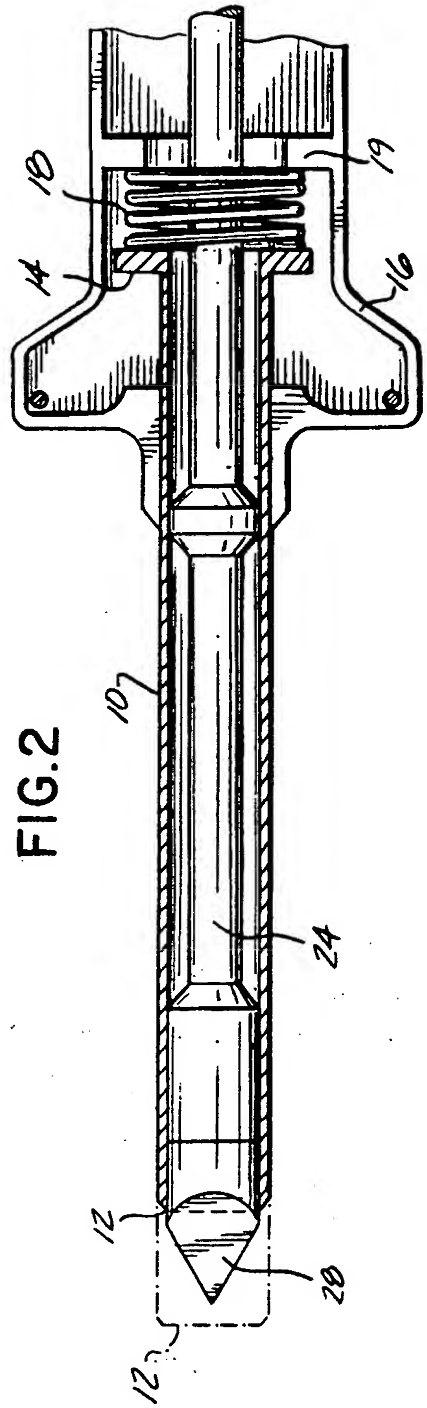

FIG.2

FIG.3

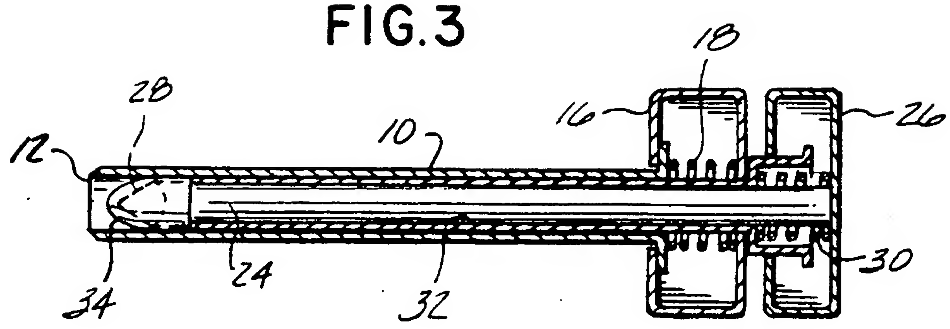

FIG.4

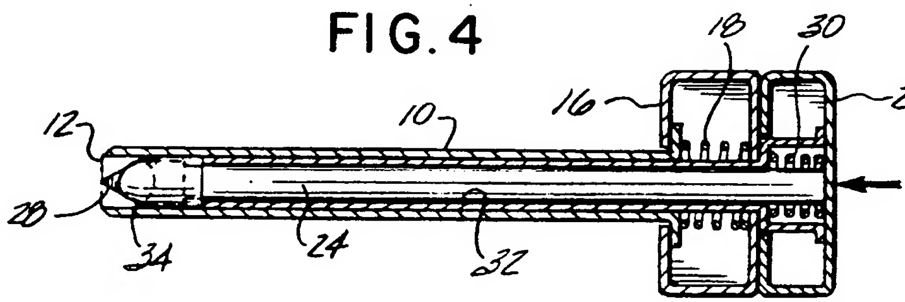

FIG.5a

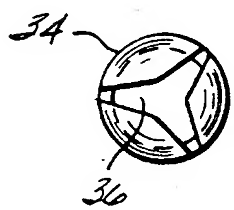

FIG.5b

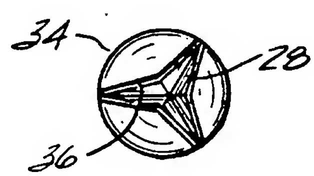

FIG.6

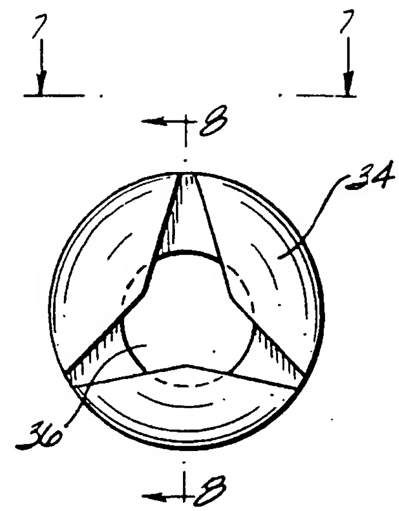

FIG.7

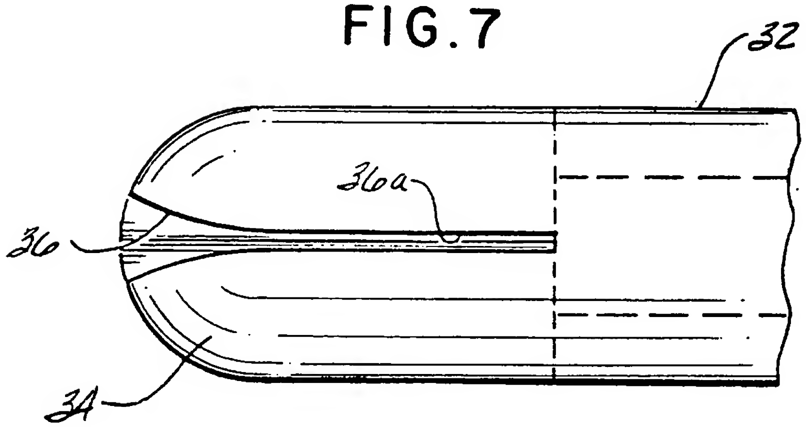

FIG.8

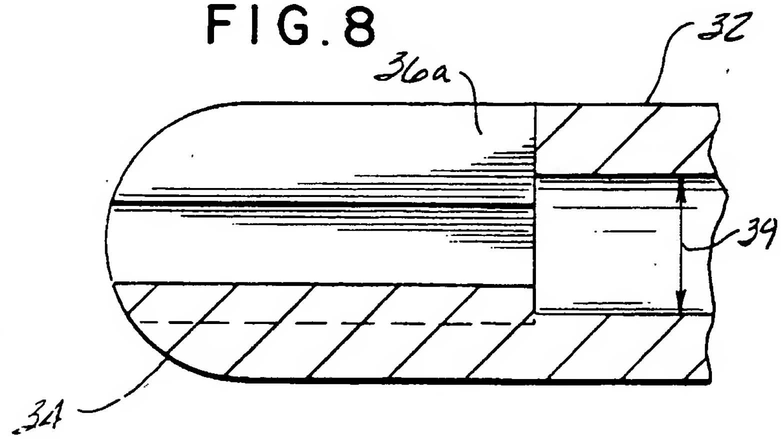

FIG. 9

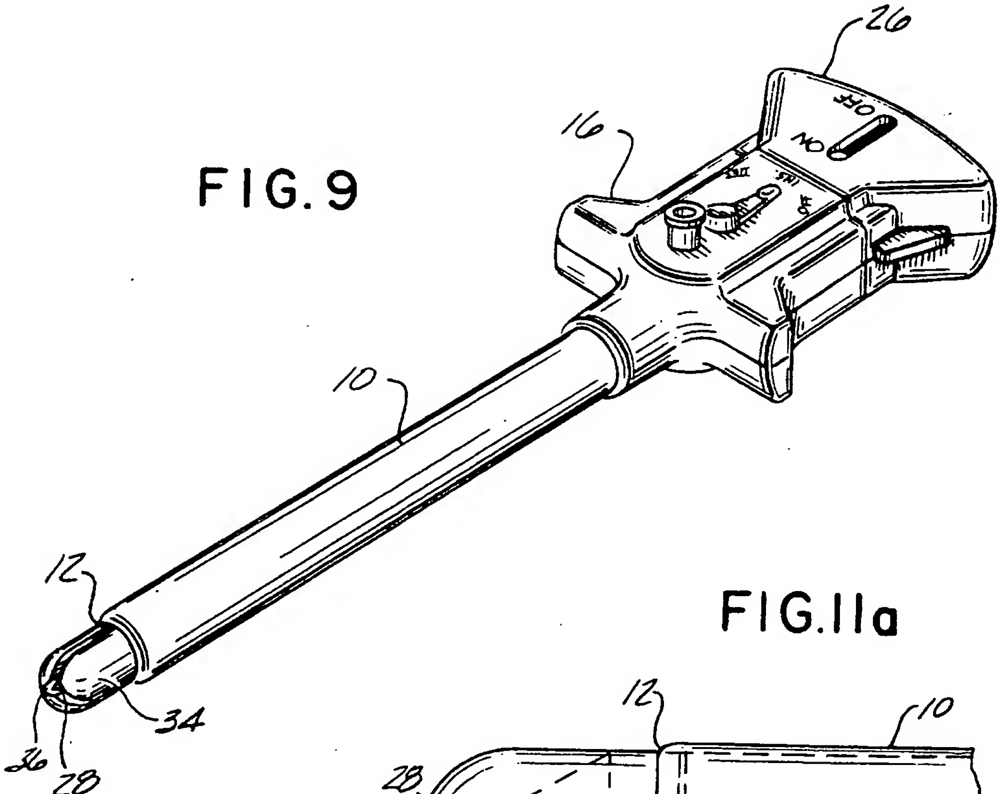

FIG. 11a

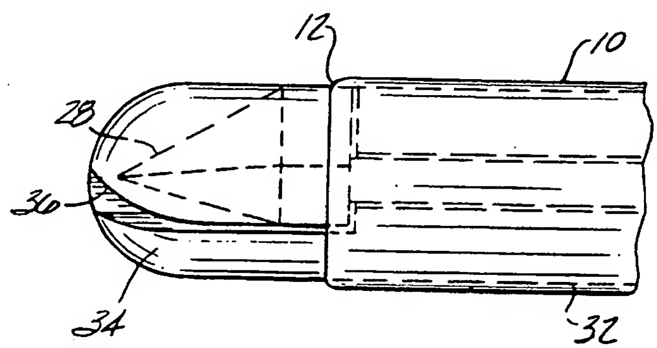

FIG. 10

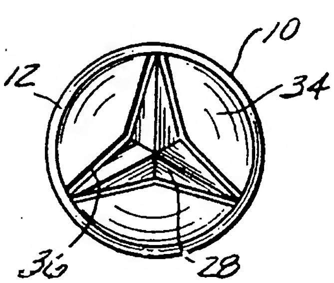

FIG. 11b

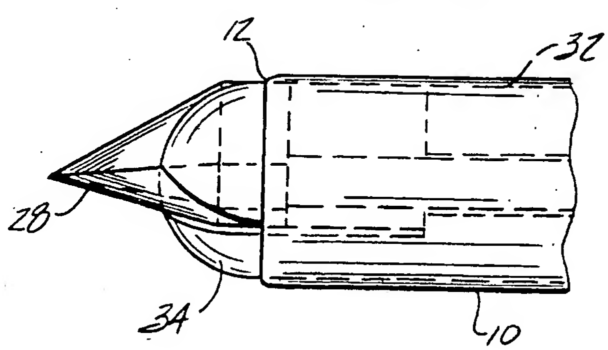

FIG.12a

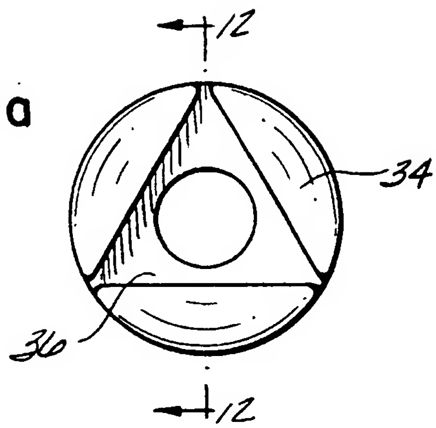

FIG.12

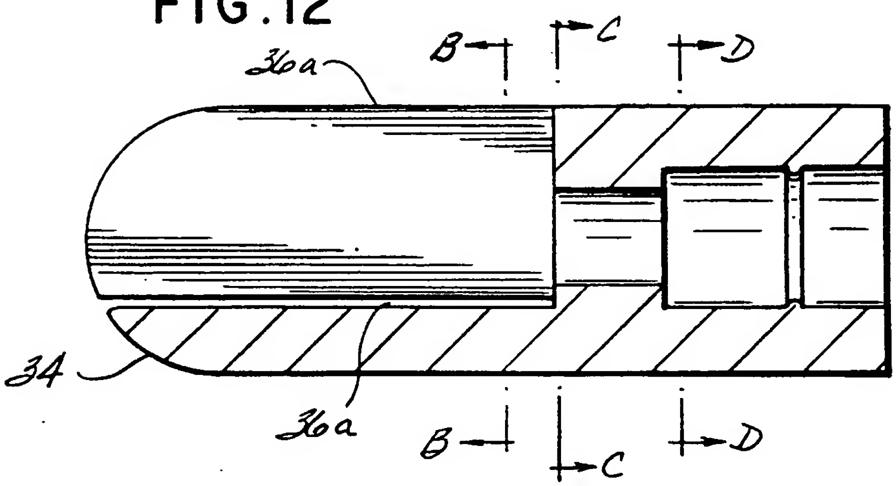

FIG.12b

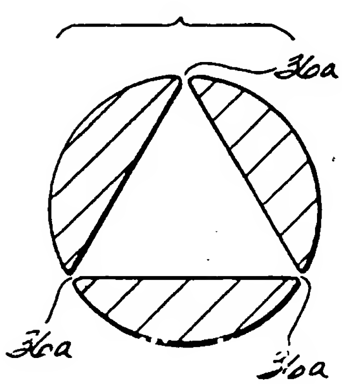

FIG.12c

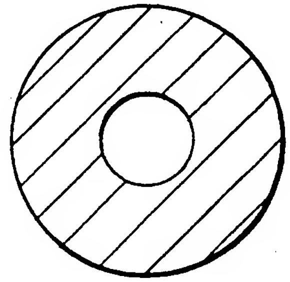

FIG.12d

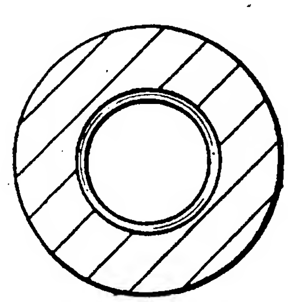

FIG.13

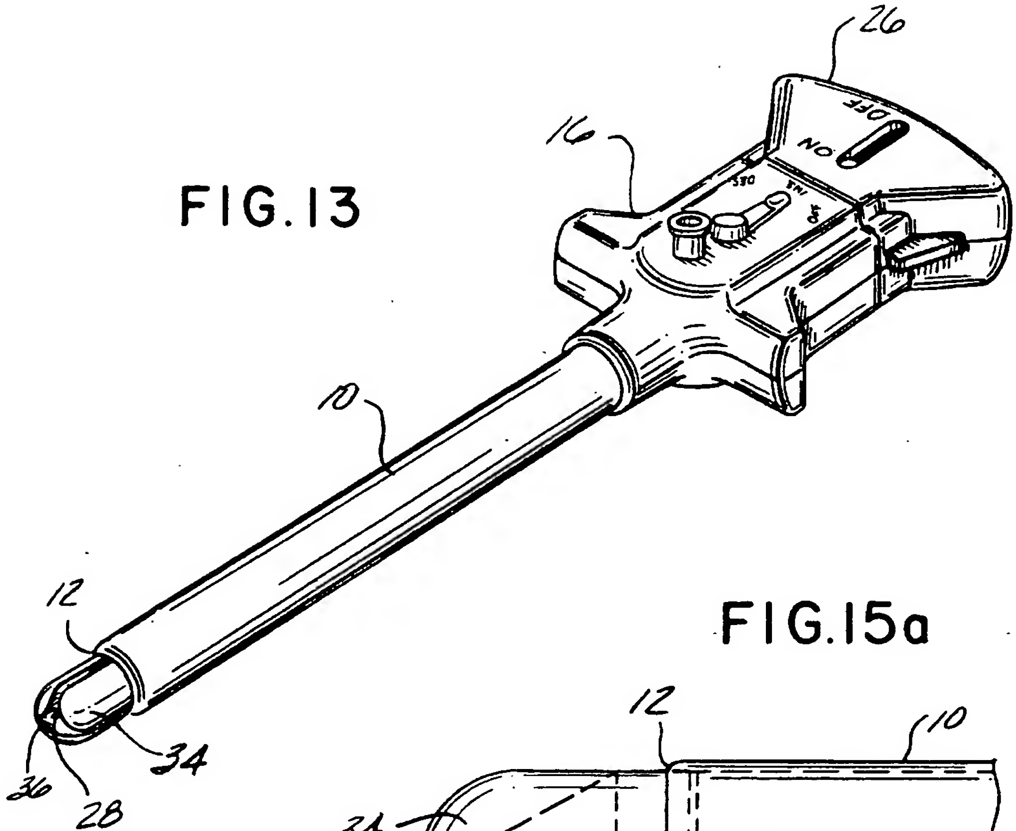

FIG.15a

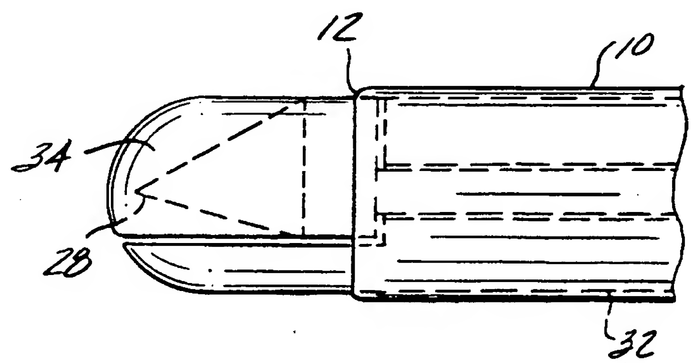

FIG.14

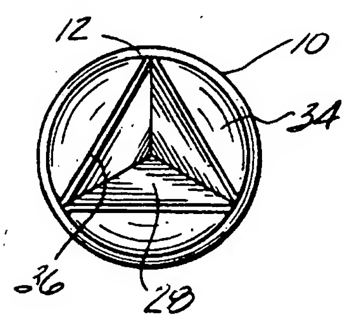

FIG.15b

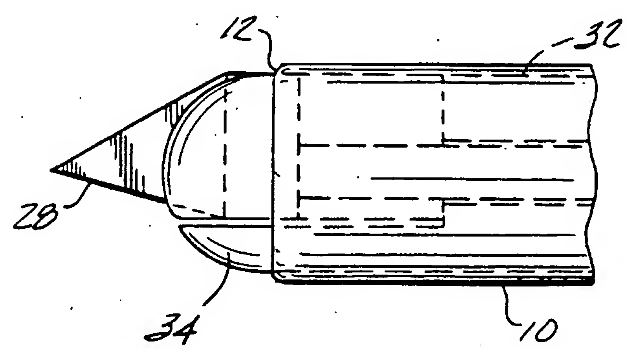

FIG.16

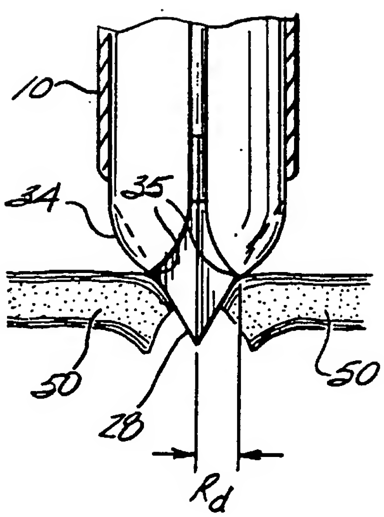

FIG.17
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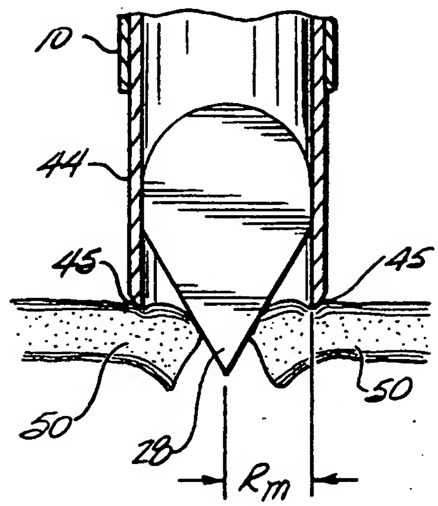


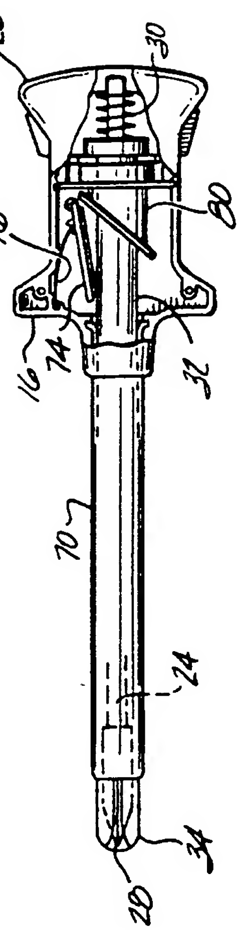


FIG.20

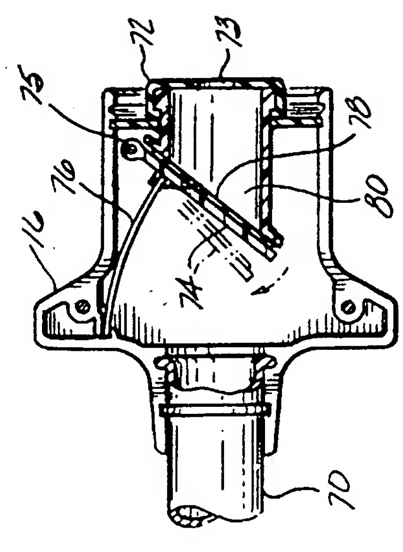


FIG.19

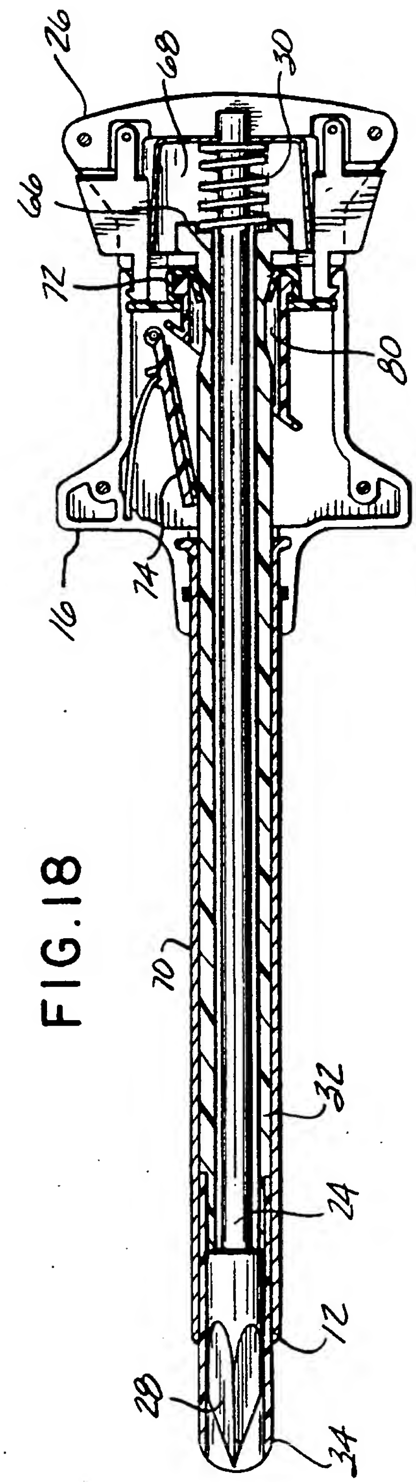


FIG.18

FIG.21

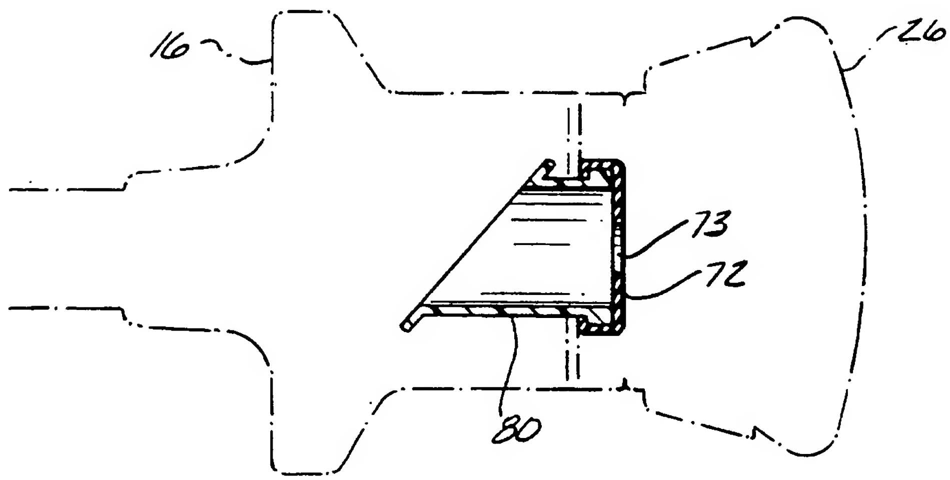
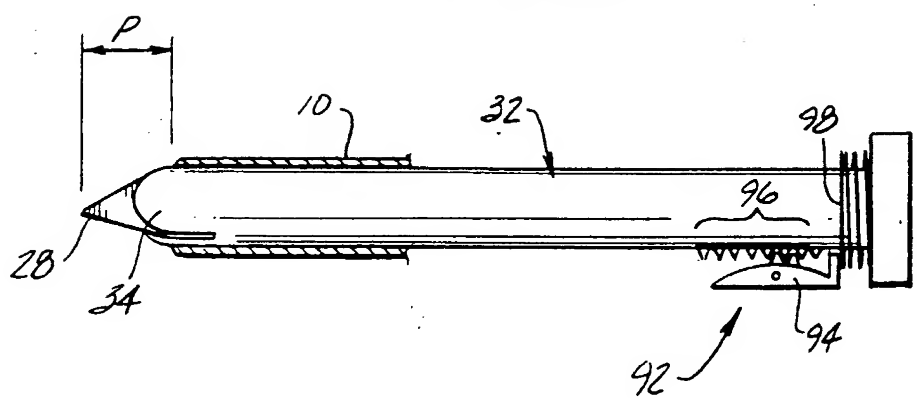


FIG.22



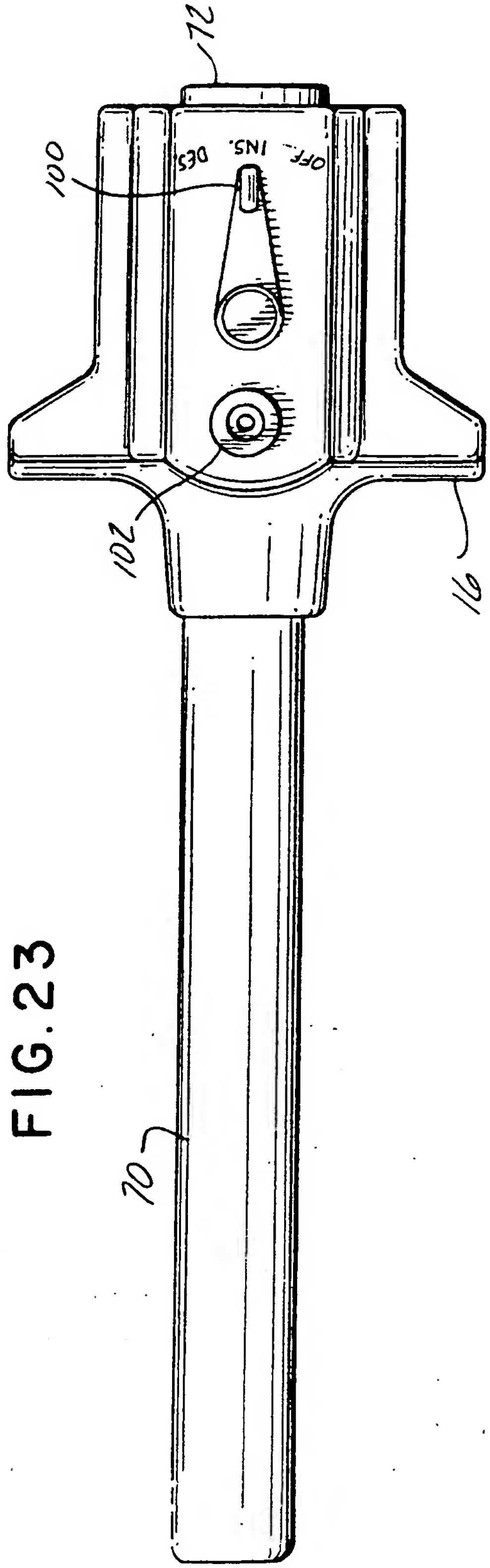

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FIG.23

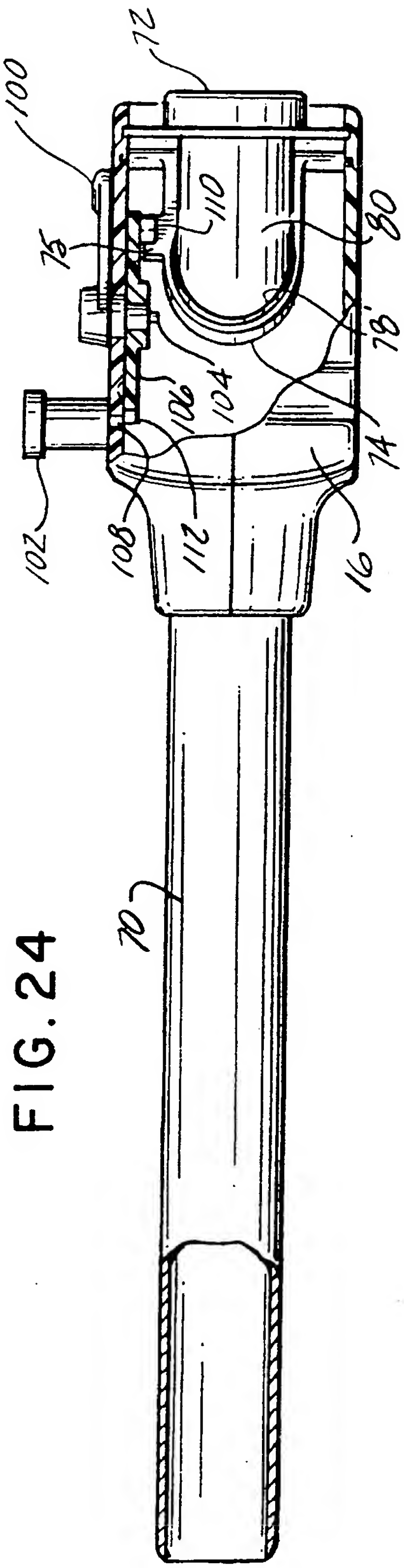
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FIG.24

FIG.25

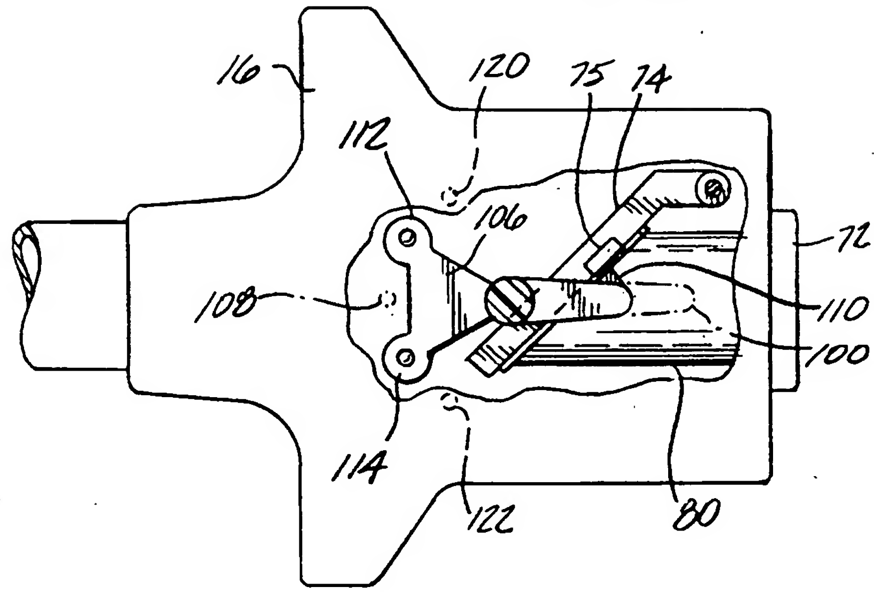
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FIG.26

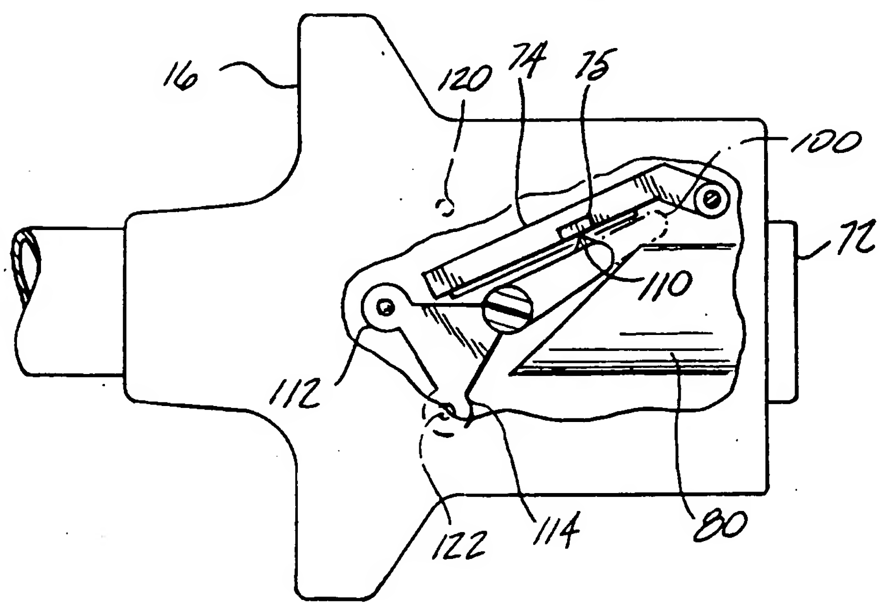
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FIG.28

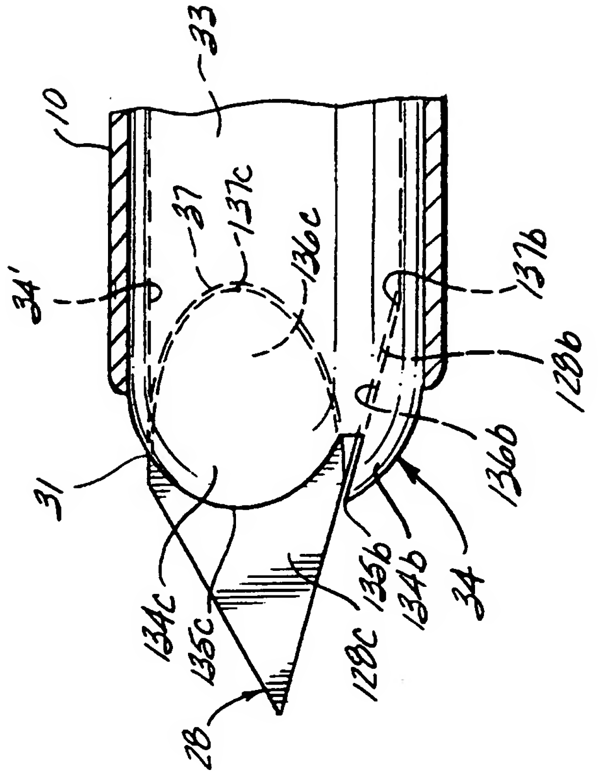
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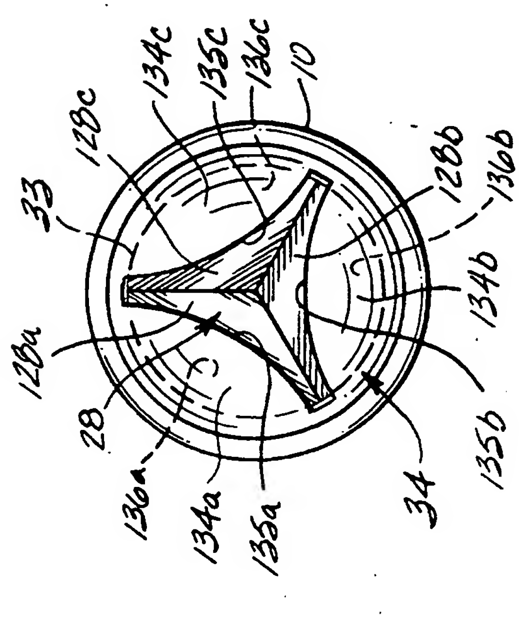
FIG.27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